Biological Forum – An International Journal **15(10): 1207-1212(2023)**

ISSN No. (Print): 0975-1130
ISSN No. (Online): 2249-3239

Morpho- Physiological Traits aided Screening of Soybean Genotypes under Rainfed Situation

A. Geetha[1]*, C.V. Sameer Kumar[2], K. Indudhar Reddy[3] and G. Neelima[4]

[1]Scientist (Crop Physiology), Regional Agricultural Research Station, Palem, PJTSAU, Nagarkurnool (Telangana), India.

[2]Principal Scientist (Plant Breeding), Regional Agricultural Research Station, Palem, PJTSAU, Nagarkurnool (Telangana), India.

[3]Scientist (Agronomy), Agroclimatic Research Centre, PJTSAU, Hyderabad (Telangana), India.

[4]Scientist (Plant Breeding), Regional Agricultural Research Station, Palem, PJTSAU, Nagarkurnool (Telangana), India.

(Corresponding author: A. Geetha)*

(Received: 27 August 2023; Revised: 23 September 2023; Accepted: 06 October 2023; Published: 15 October 2023)
(Published by Research Trend)

ABSTRACT: Soybean is one of the major rainfed crops, improper distribution of monsoon and its early cessation results in poor crop yield, which is limiting the potential exploitation of yield. Identification of drought tolerant genotypes aids in realizing the good yields. To elucidate the influence of rainfed situation on morpho-physiological characters in ten soybean genotypes, a three years study starting from *Kharif*, 2015 to 2017 (*Kharif*, 2015, 2016, 2017) was conducted at RARS, Palem, PJTSAU, Nagarkurnool. The results revealed that under rainfed conditions insufficient rains causes repressed effect on relative water content (RWC), leaf fluorescence, leaf area index and specific leaf area which in turn affects plant growth parameters like plant height (cm), total dry matter production ultimately leads to yield reduction. Among the physiological parameters, lower SLA value, higher RWC values, higher SPAD readings, optimum LAI and high fluorescence values are most desirable characters under low rainfall conditions to cope up water scarcity in plants. However, for character studied, genotypes variations were significant. From the pooled analysis data, JS-335 recorded highest seed yield of 1353 kg ha^{-1} which was on par with RKS-18 (1099 kg/ha) and the two genotypes showed yield superiority over rest of genotypes, Thus, yield superiority may be due to positive contribution of number of pods per plants and other physiological parameter like optimum LAI and high RWC. The present results are useful for efficient screening of soybean genotypes under rainfed conditions based on morphological, physiological and yield parameters which have due and practical weightage in promising genotypes selections.

Keywords: Leaf area index, rainfed, relative water content, soybean, SPAD readings, SLA, seed yield.

INTRODUCTION

Soybean is one of the world's leading oilseeds crop known for its productivity, net profitability and maintaining the soil fertility. The crop being a seed legume, contributes around 25% to the global vegetable oil production. About 85% of the world's soybeans are processed and around 98% of the soybean meal is made into animal feed. In India, soybean contributes to 43% oil pool. The crop serves as major source for farmer's income.

Soybean is majorly a rain fed crop. Under rainfed conditions, yield-limiting factor is volume and distribution of rainfall during the cultivating period (Rizzo *et al*., 2021). Due to improper distribution of monsoon and its early cessation results in poor crop yield and also due to lack of moisture crop suffers at reproductive stage. Being a rainfed crop, the drought tolerance ability is crucial in realizing yields, which also depends on variety, prevailing environment and crop management. Earlier studies showed that one third of many rainfed crop's yield variability is dependent on climate variability across the globe (Wang *et al*., 2021). Among these factors, variety selection is significant decision an expert makes to achieve high soybean yield by improving the fertilizer use efficiency and water use efficiency. The yield of soybean is a complex quantitative trait having significant influence of environmental conditions (Minmin *et al*., 2019). Differences in growth nature leads to varied yields in any crop as per the genetic makeup (Singh *et al*., 2013; Rizzo *et al*., 2021). The selection of varieties with promising physiological traits counters the stresses in crops. Appropriate selection of suitable varieties leads to sustainable soybean cultivation and net profits under rainfed environment (Li *et al*., 2020, Pragya *et al*., 2023).

So, the selection of suitable cultivar having desirable physiological traits such as high RWC, leaf fluorescence, SPAD, optimum LAI and lower SLA is highly useful as the genetic potential of a variety limits the expression of its yield. Hence, keeping this in view, the present investigation was carried out to study soybean genotypes under rainfed situation in relation with morpho-physiological parameters.

MATERIAL AND METHODS

The experiment was laid out in Randomized Block Design with ten treatments which are replicated thrice during *Kharif*, 2015 to 2017 (*Kharif*, 2015, 2016, 2017) at Regional Agricultural Research Station, Palem, PJTSAU, Nagarkurnool, Telangana State. Each genotype is laid out in Randomized Block Design with bed size of 55 × 4 meter and spacing of 30 × 10 cm. Two to three seeds were sown per hill followed by thinning at 20 DAS to retain one healthy seedling per hill. The good agricultural packages of practices were followed to raise a healthy crop. In each entry, five plants were randomly selected to take plant height, leaf area (cm^2), leaf fluorescence, SCMR, RWC (%), SLA (cm^2/g) and total dry matter production (g/plant) have been recorded at peak flowering stage. Whereas, observation on number of pods per plant, number of seeds per plant, 100 seed weight (g) and yield (kg/ha) were recorded at harvesting stage. Plant height (cm) was measured from base of the plant to the terminal bud of the plant. Total leaf area was estimated by measuring length and width of top, middle and bottom leaves using the formula. Leaf area (cm^2) = Length (cm) × Width (cm) × 0.90 × number of leaves present in plant and Leaf Area Index was calculated as leaf area present per unit of land area.

Relative Water Content (% RWC) of fully expanded leaves from the top was measured in plants. Leaf relative water content was calculated by the following equation:

Relative water content % (RWC) =

$$\frac{(\text{Fresh weight} - \text{Dry Weight})}{(\text{Turgid weight} - \text{Dry weight})} \times 100$$

The chlorophyll meter SPAD-502, Minolta was used to assess the chlorophyll concentration. The upper, middle and lower parts of each leaf were measured and the average of three readings was taken as leaf SPAD reading. The fluorescence equipment (FMS 2, Hansatech Instruments Ltd, Kings Lynn, UK) was used to measure leaf fluorescence. The calculation of parameters measured under illuminated conditions followed the nomenclature of van Kooten and Snel (1990), where $\Phi PSII = Fv' / Fm' \times qp$.

Specific leaf area (SLA) was the measure of Leaf area of a fresh leaf, divided by its oven-dry mass. Total dry matter accumulation (gm^{-2}) of harvested plants were separated into stem, leaf, petiole and capsule and kept in brown paper bags and dried to a constant weight in hot air oven at 80ºC for 48 hours. Each component of the plant was weighed in gram. 100 seed weight was obtained by counting 100 cleaned and dried seed taking measurement, whereas, seed yield was obtaining by taking weight of seed after threshing and drying.

RESULTS AND DISCUSSION

The plant height varied significantly among genotypes. From the pooled data (Table 1), the results on plant height showed that genotype KDS-780 recorded highest plant height of 35.8 cm under rainfed conditions, which is at par with five genotypes *viz.*, MACS-1442 (35.6cm), AMS-1002 (32.6 cm), Basar (32.4cm), MAUS-706 (32.2cm) and DSB-23-2(30.7 cm). Plant growth is compounded effect of division, enlargement, and differentiation of cell. Poor growth of a crop is due to impairing the mitosis and cell elongation caused due to moisture stress (Hussain *et al*., 2008), which also limits the process of cell growth significantly due to the loss of turgor (Taiz and Zeiger 2006). The poor water flow from xylem to the nearby cells (Nonami, 1998) under water deficit conditions leads to reduced plant height. Drought conditions reduced height of the plant, size of the leaf, and the stem girth in maize (Khan *et al*., 2015). In the same crop, Kamara *et al*. (2003) revealed that the biomass accumulation drastically reduced under water limited conditions.

For the parameter, leaf area index from the pooled data (table 1), two genotypes *viz*., AMS-1002 and Basar recorded highest LAI value of 3.7 under rainfed conditions which were on par with another seven genotypes studied. The value of LAI, for these seven genotypes are 3.6 for JS-335, 3.5 for the genotypes KDS-780 and DSB-23-2, 3.4 for RKS-18, 3.3 for JS-93-05 and 3.1 for JS-95-60. Number and sizes of leaves were reduced whereas, reduced turgor pressure and slow rate of photosynthesis under drought conditions mainly limit the leaf expansion (Rucker *et al*., 1995). In the present investigation, this is the reason for lower leaf area under water stress condition.

The leaf fluorescence values from pooled data (Table 2) ranged from 0.736 to 0.670. All the genotypes studied showed on par values for leaf fluorescence. Fv/Fm decreased in response to drought in all leaves, but was not significantly different. Fluorescence measurement of ‘chlorophyll a’ have been used as a powerful tool to understand, study and quantify the non-stomatal inhibition to photosynthetic efficiency (Ohashi *et al*., 2006) and screening of drought tolerant genotypes (Rahbaria *et al*., 2011) can be used to estimate yield assessment. Among genotypes under water limited conditions (Araus *et al*., 1998; Rathod *et al*., 2011). water stress reduces the variable (F_v) and initial (F_0) fluorescence parameters and quantum yield (Fv/Fm) (Paknejad *et al*., 2009). Thus, the present study identified the resistant genotypes based on values of leaf fluorescence.

SPAD chlorophyll meter readings values (table 2) ranged from 48.6 to 43.6 under rainfed conditions. The pooled data table results revealed that genotype AMS-1002 recorded highest SPAD chlorophyll meter reading of 48.6 which was on par with rest of remaining eight genotypes. While, only one genotype, KDS-780 recorded lowest SCMR value of 43.6. The decrease in chlorophyll content under drought stress has been considered a major symptom of oxidative stress and may the result of pigment photo-oxidation and chlorophyll degradation (Farooq *et al*., 2009) and alters chlorophyll during moisture stress was assessed in many crop species, depending on the duration and severity of moisture stress (Kypoarissis *et al*., 1995; Zhang and Kirkham 1996). Loss of chlorophyll under drought is due to inactivation of photosynthesis. SPAD chlorophyll meter (Minolta Corp., Ramsey, New Jersey, USA), which measures unit less value referred as SPAD chlorophyll meter reading (SCMR). It is also corresponding to chlorophyll content in leaves correlates with SLA and SLN (Rao *et al*., 2001). Hence, the values obtained in the present investigation were recorded using the above equipment. Thus, SCMR values from the present study can be used as a effective alternative to estimate WUE at least as an initial screening of soybean germplasm in water limited cultivation regions.

Relative water content (RWC) is vital for metabolic activity and leaf survival. Relative water content results from the pooled data (Table 3) revealed that, the three genotypes JS-335, Basar and JS-93-05 maintained higher RWC value of 71% which are on par with rest of seven genotypes. The RWC value for DSB-25-2 is 70% followed by four genotypes *viz*., JS-95-60, RKS-18, AMS-1002 and MACS-1442, which has RWC value of 69%. While, two genotypes, MACS-1442 and MAUS-706 maintained RWC of 68%. Schonfeld *et al.* (1988) reported that the cultivars that are resistant to drought had more RWC due to which in the present investigation, the better performing genotypes have more RWC. Relative water content is probably the most appropriate measure of plant water status in terms of the physiological consequence of cellular water deficit. For the similar leaf water potential, two different cultivars can have varied leaf RWCs with corresponding differences in hydration and water deficit of leaf and physiological water status, which helps in identification of hydration in cells under effect of both leaf water potential and osmotic adjustment.

Lower specific leaf area values, under limited water conditions are one of desirable character for survival of plants. From the pooled data (Table 3), it is evident that, 50% of genotypes were maintaining lower specific area in order to cope up limited water condition. Among them, genotype JS-93-05 maintained lower specific leaf area value of 217(cm^2/g) followed by Basar (230 cm^2/g), MAUS-1442(251 cm^2/g), MAUS-706(274 cm^2/g) and JS-93-05(286 cm^2/g). SLA is the ratio of leaf area to its dry weight and is indirect measure of leaf expansion. A positive correlation between SLA and Δ13C has been demonstrated in groundnut (Rao *et al*., 2001).

Dry matter production under rainfed conditions does not show much deviation among genotypes studied. From the pooled data (Table 4), it is evident that, JS-335 recorded highest dry matter production value of 0.288g per plant, which was at par with rest of nine genotypes. Total dry matter accumulation is the sum total of weight of leaves, stem and seed weights of cell affects plant growth and DMP. Hence, JS-335 is the better performed for DMP and yields.

The values for number of pods per plant (Table 4) ranged from 106 to 45 under rainfed conditions. The pooled data table results revealed that, the genotypes JS-95-06, recorded lowest number of pods per plant. Whereas, highest pods per plant has recorded for Basar with 106 pods per plant followed by JS-335 which recorded 102 pods per plant, AMS-1002 recorded 100 pods per plant, while DSB-23-2 recorded 94 pods per plant, JS-93-05 recorded 82 pods per plant and KDS-780 recorded 81 pods per plant. For the character, hundred seed weight (table 5) genotype, MACS-1442 recorded highest hundred seed weight of 13.0g followed by KDS-780 which recorded hundred seed weight of 12.6, DSB-23-2 recorded 12.0 g hundred seed weight and two genotypes JS-335 and RKS-18 recorded 100 seed weight of 11.9 g.

The final yield of any crop depends on the source and sink relationship and on different components of sink such a*s* number of pods per each plant and 100 seeds weight. Source other components are the number of leaves, LAI and pre-anthesis assimilate reserves *etc*., before flowering. Final yield, hence, is a function of all the above components of source as well sink underlining at various phenophases of growth of a plant. It is evident from the present investigation such that genotypic effect on seed yield was significant under rainfed conditions (Table 5). Genotype JS-335 recorded highest and significantly superior seed yield of 1353 kg/ha was recorded, which was at par with R.K.S-18 (1099 kg/ha).

Table 1: Effect of rainfed conditions on plant height and leaf area during Kharif -2015, 2016 and 2017 and pooled in soybean genotypes.

Plant height (cm)				Leaf area index			
Kharif, 2015	**Kharif, 2016**	**Kharif, 2017**	**Pooled**	**Kharif, 2015**	**Kharif, 2016**	**Kharif, 2017**	**Pooled**
35.00	33.93	27.60	32.2	3.10	2.81	2.75	2.9
33.33	29.33	23.07	28.6	3.20	3.00	2.97	3.1
30.33	30.00	22.47	27.6	2.89	3.53	3.66	3.4
35.33	32.33	24.53	30.7	3.35	3.68	3.54	3.5
34.67	28.67	24.00	29.1	3.50	3.66	3.64	3.6
32.00	23.67	26.67	27.4	3.37	2.92	3.71	3.3
34.67	37.00	26.00	32.6	3.53	3.76	3.82	3.7
33.00	36.67	27.40	32.4	2.93	4.01	4.06	3.7
32.67	43.67	31.13	35.8	2.45	4.02	4.08	3.5
39.67	41.40	25.60	35.6	2.52	3.30	3.03	3.0
C.D. at 5%			5.832				0.65
S.E(m)			1.948				0.217
S.E(d)			2.755				0.30
C.V.			10.817				11.211

Table 2: Effect of rainfed conditions on leaf fluorescence and SCMR during *Kharif* -2015, 2016 and 2017 and pooled in soybean genotypes.

Leaf florescence				SCMR			
Kharif, 2015	Kharif, 2016	Kharif, 2017	Pooled	Kharif, 2015	Kharif, 2016	Kharif, 2017	Pooled
0.63	0.72	0.71	0.688	46.67	48.50	46.60	47.26
0.77	0.75	0.68	0.733	42.67	45.30	47.82	45.26
0.65	0.74	0.71	0.699	43.16	49.40	46.93	46.50
0.64	2.85	0.73	1.408	41.60	49.90	48.39	46.63
0.75	2.81	0.78	1.447	44.21	42.43	46.45	44.37
0.75	0.64	0.62	0.670	43.72	46.57	46.55	45.61
0.73	0.69	0.70	0.708	49.67	51.60	44.78	48.68
0.68	0.74	0.64	0.689	43.67	44.77	44.97	44.47
0.67	0.73	0.72	0.706	43.83	40.63	46.33	43.60
0.64	0.67	0.70	0.670	48.00	48.27	45.27	47.18
C.D. at 5%			0.08				4.31
S.E(m)			0.294				1.441
S.E(d)			0.416				2.037
C.V.			11				5.429

Table 3: Effect of rainfed conditions on specific leaf area and relative water content during Kharif -2015, 2016 and 2017 and pooled in soybean genotypes.

Specific leaf area ($cm^{2/}g$)				Relative water content (%)			
Kharif, 2015	Kharif, 2016	Kharif, 2017	Pooled	Kharif, 2015	Kharif, 2016	Kharif, 2016	Pooled
254.33	225.67	342.67	274	70.67	66.87	67.33	68
167.33	206.67	278.00	217	64.00	70.73	73.00	69
277.33	293.00	317.67	296	76.00	63.90	67.67	69
295.00	314.67	352.33	321	70.83	71.20	67.33	70
316.67	273.33	428.33	339	75.23	67.63	69.33	71
265.00	308.67	283.33	286	78.00	66.30	68.33	71
247.33	348.67	468.00	355	70.00	75.50	61.33	69
224.00	281.33	184.33	230	70.67	68.17	73.67	71
229.00	260.67	346.67	279	64.47	71.47	66.67	68
214.00	221.00	316.67	251	69.37	70.60	67.33	69
C.D. at 5%			78				8
S.E(m)			26				3
S.E(d)			37				4
C.V.			15.912				6

Table 4: Effect of rainfed conditions on dry matter content and pods per plant during *Kharif* -2015, 2016 and 2017 and pooled in soybean genotypes.

Dry matter production (g/plant)				No. of pods per plant			
Kharif, 2015	Kharif, 2016	Kharif, 2017	Pooled	Kharif, 2015	Kharif, 2016	Kharif, 2017	Pooled
0.22	0.23	0.19	0.215	66.60	69.33	73.87	70
0.98	0.97	0.44	0.795	45.00	51.33	38.53	45
0.27	0.26	0.24	0.259	65.20	81.00	69.00	72
0.31	0.29	0.28	0.295	98.47	107.33	77.60	94
0.36	0.30	0.24	0.298	95.20	116.67	92.67	102
0.18	0.17	0.20	0.183	66.93	106.00	72.33	82
0.24	0.24	0.24	0.240	96.80	109.67	93.93	100
0.29	0.29	0.27	0.283	101.67	104.67	112.13	106
0.28	0.29	0.17	0.248	81.87	77.67	84.53	81
0.22	0.27	0.21	0.232	78.00	97.00	86.47	87
C.D. at 5%			0.164				15
S.E(m)			0.055				5
S.E(d)			0.077				7
C.V.			31.14				10

Table 5: Effect of rainfed conditions on 100 seed weight and yield per plant during *Kharif* -2015, 2016 and 2017 and pooled in soybean genotypes.

100 seed weight (g)				Seed yield (Kg/ha)			
Kharif, 2015	**Kharif, 2016**	**Kharif, 2017**	**Pooled**	**Kharif, 2015**	**Kharif, 2016**	**Kharif, 2017**	**Pooled**
12.38	10.51	11.05	11.3	3200	1893	3443	2845
11.30	11.91	11.35	11.5	2744	2512	2599	2618
12.83	11.42	11.37	11.9	3370	5956	3569	4298
12.11	12.04	11.72	12.0	3233	2307	2936	2825
12.70	11.55	11.39	11.9	4530	5661	1985	4059
11.77	11.15	11.74	11.6	4331	1757	2549	2879
12.55	11.18	11.74	11.8	3153	3903	2637	3231
11.33	9.99	10.31	10.5	2044	2301	3188	2511
14.54	11.74	11.61	12.6	2808	690	3960	2486
13.02	13.66	12.27	13.0	953	1140	2193	1429
C.D. at 5%			1.074				272
S.E(m)			0.359				117.09
S.E(d)			0.507				128.483
C.V.			5.260				16.15

CONCLUSIONS

From the present investigation, it can be concluded that during selection of promising genotypes for agronomic performance in rainfed areas with water limitations, due weightage should be given to morpho-physiological parameters to have practical results under water limited conditions to realize fullest genetic potential. The present results are useful for efficient screening of soybean genotypes under rainfed conditions based on morphological, physiological and yield parameters which have due and practical weightage in promising genotypes selections.

FUTURE SCOPE

Appropriate selection of suitable varieties leads to sustainable soybean cultivation and net profits to farmers under rainfed environment. Hence, the efficient screening of soybean genotypes under rainfed conditions based on morphological, physiological and yield parameters will be more robust if molecular aspects underlining the drought tolerant mechanism are unraveled. Membrane integrity and electrolyte leakage studied may also be taken up for practical weightage in promising genotypes while they are due for selection.

Acknowledgement. I would like to extend my sincere thanks to ADR, Palem and PJTSAU for facilitating the amenities to carry out the above work.
Conflict of interest. None.

REFERENCES

Araus, J. L., Amaro, T., Voltas, J., Nakkoul, H. and Nachit, M. M. (1998). Chlorophyll fluorescence as a selection criterion for grain yield in durum wheat under Mediterranean conditions. *Field Crops Research*, *55*, 209-23.

Farooq, M., Wahid, A., Kobayashi, N., Fujita, D. and Basra, S. M. A. (2009). Plant drought stress: effects, mechanisms and management. *Agronomy for Sustainable Development, 29,* 185-212.

Rizzo, G., Sebastian, R., Mazzilli, Oswaldo E., Walter, E., Baethgen and Andres G. Berger (2021). Season-specific management strategies for rainfed soybean in the South American Pampas based on a seasonal precipitation forecast, *Agricultural Systems*, *196*, 103331.

Hussain, M., Malik, M. A., Farooq, M., Ashraf, M. Y., Cheema. and M. A. (2008). Improving Drought tolerance by exogenous application of glycinebetaine and salicylic acid in sunflower. *Journal of Agronomy and Crop science, 194*, 193–199.

Kamara A. Y., Menkir A., Badu-Apraku B. and Ibikunle O. (2003). The influence of drought stress on growth, yield and yield components of selected maize genotypes. *J. Agric. Sci., 141,* 43–50.

Khan, M. B., Hussain, M., Raza, A., Farooq, S. and Jabran, K. (2015). Seed priming with $CaCl_2$ and ridge planting for improved drought resistance in maize. *Turkish Journal of Agricultural sciences, 39*, 193–203.

Kypoarissis, A., Petropoulun, Y. and Manetas, Y. (1995). Summer survival of leaves in a soft leaved shrub (*Phlomis fruticosa* L., Labiatae) under Mediterranean field conditions: avoidance of photo-inhibitory damage through decreased chlorophyll contents. *Journal of Experimental Botany*, *46*, 1825-31.

Li, M., Liu, Y., Wang, C., Yang, X., Li, D., Zhang, X., Xu, C., Zhang, Y., Li, W. and Zhao, L. (2020). Identification of Traits Contributing to High and Stable Yields in Different Soybean varieties Across Three Chinese Latitudes. *Frontiers in Plant Sciences*, *10,* 1642.

Nonami, H. (1998). Plant water relations and control of cell elongation at low water potentials. *Journal of Plant Res Earch, 111*, 373–382.

Ohashi, Y., Nakayama, N., Saneoka, H. and Fujita, K. (2006). Effects of drought stress on photosynthetic gas exchange, chlorophyll fluorescence and stem diameter of soybean plants. *Biologia Plantarum, 50,* 138-41.

Paknejad, F., Mirakhori, M., Al-Ahmadi, M. J., Tookalo, M. R., Pazoki, A. R. and Nazeri, P. (2009). Physiological response of soybean (*Glycine max*) to foliar application of methanol under different soil moistures. *American Journal of Agricultural and Biological Sciences*, *4,* 311-318.

Pragya, N., Ajay Kumar, B.S., Mahapatra, Priya Bisht, D. K., Shukla, R. K., Sharma and Mandeep Rawat (2023). Growth, Rainfall Use Efficiency and Economics of Soybean [*Glycine max* (L.) Merrill] Varieties as Influenced by Intense Spacing under Ridge and

Furrow Planting System in Western Himalayas. *Biological Forum – An International Journal, 15*(8a), 414-420.

Rahbaria, R., Nejad, R. K., Ganjeali. A., Bagheri, A. and Najafi, F. (2011). Drought stress effects on photosynthesis, chlorophyll fluorescence and water relations in tolerant and susceptible chickpea (*Cicer Arietinum* L.) genotypes. *Acta Biologica Cracoviensia Series Botanica*, *53,* 47-56.

Rao, R. C. N., Talwar, H. S. and Wright, G. C. (2001). Rapid assessment of specific leaf area and leaf nitrogen content in peanut (*Arachis hypogaea* L.) using a chlorophyll meter. *Journal of Agronomy and Crop Science, 189*, 175–182.

Rucker, K. S., Kvien, C. K., Holbrook, C. C. and Hook, J. E. (1995). Identification of peanut genotypes with improved drought avoidance traits. *Peanut Science, 24,* 14–18.

Schonfeld, M. A., Johnson, R. C., Carver, B. F. and Mornhinweg, D. W. (1988). Water relations in winter wheat as drought resistance indicators. *Crop Science, 28*, 526-531.

Taiz, L. and Zeiger E. (2006). *Plant Physiology,* 4th Edn. Sunderland, MA: Sinauer Associates Inc Publishers.

Wang, Z., Kaiyu Guan, Bin Peng, Zhuo Wang, Rong Fu, Bo Li, Elizabeth A. Ainsworth, Evan DeLucia, Lei Zhao and Zhangliang Chen (2021). A generic risk assessment framework to evaluate historical and future climate-induced risk for rainfed corn and soybean yield in the U.S. Midwest. *Weather and Climate Extremes, 33*, 100369.

Zhang, J. and Kirkham, M. B. (1996). Antioxidant response to drought in sunflower and sorghum seedlings. *New Phytology*, *132*, 361-373.

How to cite this article: A. Geetha, C.V. Sameer Kumar, K. Indudhar Reddy and G. Neelima (2023). Morpho- Physiological Traits aided Screening of Soybean Genotypes under Rainfed Situation. *Biological Forum – An International Journal, 15*(10): 1207-1212.